New England Industrial Trawl Fishery

The industrial trawl fishery in the broad sense began in New England during the late 40's. That part of the fishery that contributed so heavily to New England landings during the last decade existed primarily because of the sizeable demand for protein animal food supplements. For a time, 1954-1959, landings averaged over one hundred million pounds a year. This fishery declined rapidly coincident with the development of the Peruvian anchovy fishery and the local decrease in abundance of menhaden. Another segment of the industrial fishery, that for pet and mink food, has continued to develop at a slow but steady pace, landing at present about 25 million pounds a year.

The animal food protein supplement industry used all species caught and landed. The fishery depended largely upon the red hake, an abundant and otherwise unutilized species. The silver hake contributed significantly to the catch from Gulf of Maine grounds making up about 25 percent of the total catch by weight, and less than 15 percent from southern New England areas, while the red hake made up about 50 percent and 70 percent of the total catch respectively. The remainder of the catch included a variety of species, most of which had little or no commercial value.

The fishery has been described in the following short papers:

Edwards, R. L. and F. E. Lux. 1958.
New England's Industrial Fishery. CFR, Vol. 20, No. 5.

Edwards, R. L., 1958.
Gloucester's Trawl Fishery for Industrial Fish. CFR, Vol. 20, No. 8.

The species composition of the catches has been reported in the following Special Scientific Reports:

Edwards, R. L., 1958.
Species composition of industrial trawl landings in New England, 1957. SSR 266.

Edwards, R. L. and L. Lawday, 1960.
Species composition of industrial trawl landings in New England, 1958. SSR 346.

At the present time the industrial fishery shows signs of increasing activity. Mink food landings, the catch is sorted to remove everything but red and silver hake, average around 25 million pounds a year. Quaker Oats has set up a pet food plant in New Bedford with the capability of handling about 1 million pounds a week. In the summer of 1963, approximately 71 million pounds of unsorted trawl species were landed for reduction at Amagansett, Long Island.

GLOUCESTER'S TRAWL FISHERY FOR INDUSTRIAL FISH

By Robert L. Edwards*

DISCUSSION AND SUMMARY

The Gloucester trawl industrial fishery is based primarily on a whiting economy, in contrast to that of southern New England which is based on a flounder economy. Red hake are the principal species landed for reduction at Gloucester, with whiting ranking second in quantity. On southern New England grounds, skates make up a considerable portion of the trawl industrial landings, but in the Gulf of Maine, several species, depending on area and season, take third place. These include the angler, eelpout, and alewife. Only very small quantities of food fish are landed in the industrial catch at New Bedford and Pt. Judith from southern grounds while consistent small percentages of haddock, dab, and white hake show up in Gulf of Maine landings.

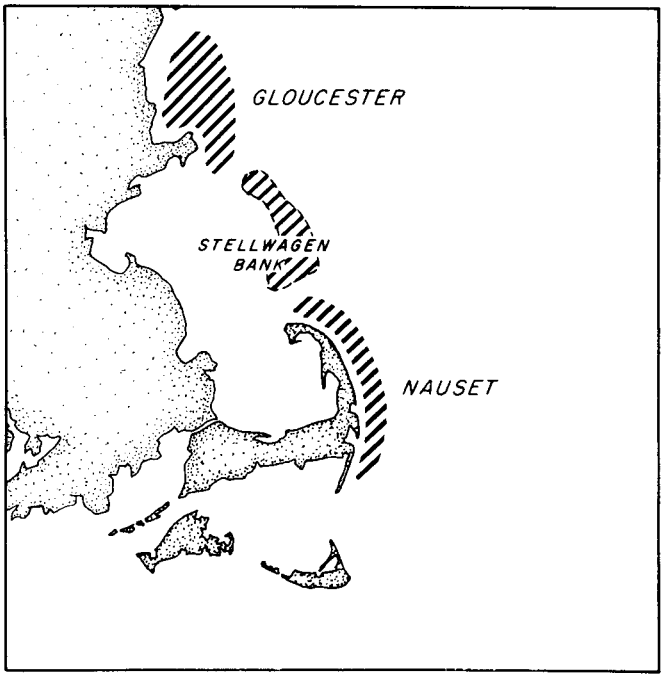

Fig. 1 - The three principal areas fished by Gloucester trawl fleet fishing for industrial fish.

The term "industrial fish" as used here refers to those species commonly taken by trawlers and referred to as "trash fish." They are taken along with desired food species and sold separately for reduction to fishery byproducts or meal plants.

Menhaden are industrial fish in the strict sense of the word, but they are the object of a highly specialized purse-seine fishery and they are not covered in this article. Because of their high oil content, reduction plants prefer menhaden since they yield both meal and oil. Industrial trawl fish are useful only as a source of meal because they contain only very small amounts of oil.

Table 1 - Gloucester Trawl Industrial Fish and Menhaden Landings by Month, 1955 to 1957

Months	1957		1956		1955	
	Trawl Fish	Menhaden	Trawl Fish	Menhaden	Trawl Fish	Menhaden
	(1,000 Lbs.)					
January	127		100		421	
February	65		24		344	
March	25		54		66	
April	8		100		272	
May	1,762		735		2,110	
June	3,330	1,513	1,775	8,384	609	5,558
July	4,540	13,300	1,100	36,236	254	20,577
August	6,117	3,577	2,175	17,832	2,925	21,371
September	7,454	2,311	3,348	3,957	1,399	12,672
October	7,362		2,009		2,519	1,102
November	5,500		2,400		2,022	
December	1,351		2,163		1,290	
Totals	37,641	20,701	15,983	66,409	14,224	61,280

The trawl fishery for industrial fish started in Gloucester as elsewhere in New England in 1949. The Gloucester landings of this fishery have not been very consistent or large, although in recent years a slow but steady increase has occurred. As a result of the very poor landings of menhaden in 1957, the Gloucester landings of trawl industrial fish more than doubled, amounting to over 37 million pounds (see table 1). During this same year, over 42 million pounds were landed at New Bedford and almost 100 million pounds landed at Pt. Judith.

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The Gulf of Maine and southern New England trawl industrial fisheries differ in their emphasis on food species. In general, the southern New England fishery is based on a flounder economy, directing its effort toward the capture of yellowtail flounder, fluke, and blackback flounder, in addition to red hake and other "trash" species. The Gloucester whiting-industrial fishery is primarily for whiting with secondary interest in such groundfish as haddock, cod, white hake, and pollock. The Gloucester whiting-industrial fishery may be said to be based on a whiting economy.

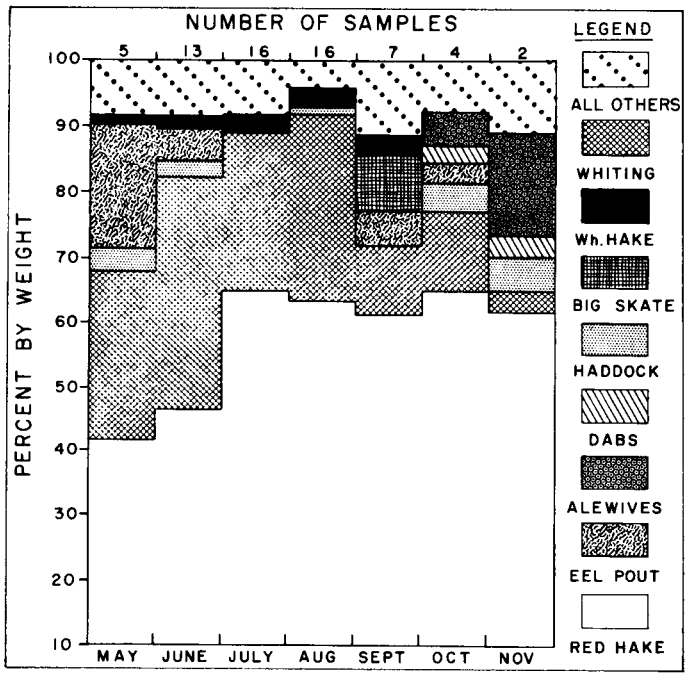


Fig. 2 - Percentage by weight species composition of trawl industrial fish landings at Gloucester from the Nauset area. Data for 1956 and 1957 have been combined.

FISHING AREAS

The trawl industrial fish landed at Gloucester are mainly taken from three grounds (see fig. 1), the Nauset area along Cape Cod's outer shore, Stellwagen Bank, and the local grounds around Cape Ann. The location of the fleet depends upon weather, the season, and the relative abundance of fish, especially whiting. Although the fleet is occasionally found concentrated on the local Gloucester grounds or Stellwagen Bank, the Nauset area contributes 80-90 percent of the total landings. Stellwagen Bank contributes the second largest share, and the local Gloucester grounds contribute the least.

If the demand for trawl industrial fish continues to increase, the amount of fishing on these various grounds will certainly change, and additional areas will be exploited to supply this demand. Concentrations of red hake will be sought in addition to whiting.

Table 2 - Percentage by Weight of Species Composition of the Trawl Industrial Fish Landings at Gloucester from the Three Principal Areas for the Entire Period for Which Information is Available

Species	Area and Period Covered		
	Nauset (May-Nov.)	Stellwagen (June-Jan.)	Gloucester (May-Nov.)
Red hake	57.5	33.8	43.9
Whiting	21.7	39.1	13.3
Eelpout	5.1	1.6	2.6
Alewife	3.4	2.6	9.3
Haddock	2.7	1.8	2.9
Herring	2.7	2.2	2.0
White hake	1.7	1.0	0.8
Big skate	1.6	-	0.5
Spiny dogfish	1.5	1.9	3.0
Dab	1.1	5.1	3.7
Little skate	0.4	0.5	1.0
Longhorn sculpin	0.4	0.3	0.2
Shad	0.3	0.2	2.0
Sea raven	0.3	0.1	-
Barndoor	0.2	0.1	2.2
Fourspot flounder	0.1	-	-
Rockling	0.1	2.1	0.3
Yellowtail	0.1	-	-
Cod	0.1	0.1	0.3
Sea eel	0.1	0.6	-
Ocean perch	0.1	1.2	1.3
Pollock	0.1	0.1	-
All others	0.3	0.5	0.1
Angler	-	4.3	10.2
Blackback		0.1	0.2
Grey sole	-	0.5	0.2
Number of Samples	63	21	20

SPECIES COMPOSITION

The species composition of the landings is presented graphically for each fishing ground (figs. 2-4). Upwards of 20 species may be included in individual catches in significant quantities, depending on the season and the area fished. To keep the graphs reasonably simple, only those species that appear consistently and in some quantity are plotted. The "all others" category on the graphs does not include significant quantities of species of particular interest here.

Figure 2, the percentage by weight of species composition of landings from the Nauset area, indicates that the red hake (Urophycis chuss) makes up the bulk of the fish landed, being approximately 55 percent of the total for the entire period.

The whiting, or silver hake (Merluccius eilinearis), makes up about 22 percent of the landings, with the eelpout (Macrozoarces americanus) ranking as a poor third, or about 5 percent of the total. It should be observed that only three food species (other than whiting), haddock (Melanogrammus aegelefinus), dab (Hippoglossoides platessoides), and white hake (Urophycis tenuis) appear in any number and constitute only a very small part of the landings, in all less than 6 percent.

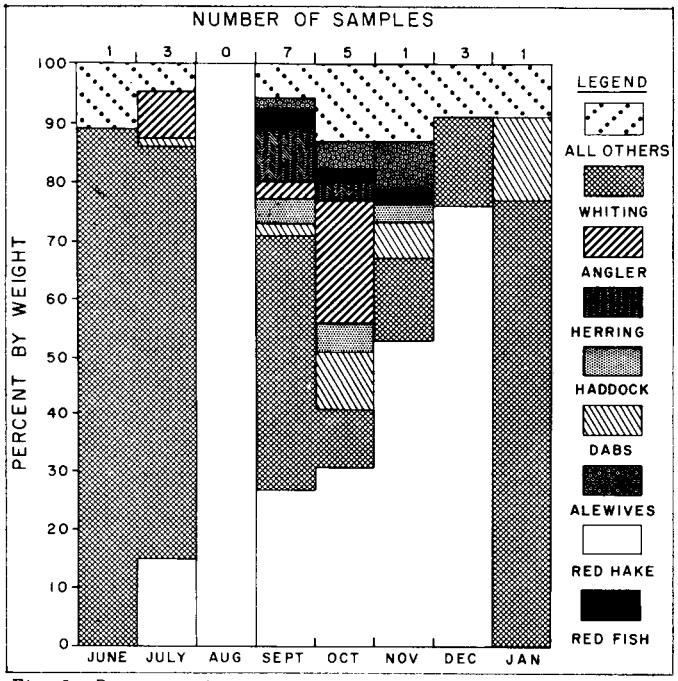


Fig. 3 - Percentage by weight species composition of trawl industrial fish landings at Gloucester from Stellwagen Bank. Data for 1956 and 1957 have been combined.

The composition of the landings from Stellwagen Bank (fig. 3) is quite different. Red hake do not make up the bulk of the landings until fall and early winter in sharp contrast to the other areas. Whiting dominate the catch in the summer and fall. The red hake and whiting together make up approximately 73 percent of the total catch. Dabs are present in significant quantities, making up about 5 percent of the total landings. The white hake and haddock appear consistently but make up a very small part of the total catch.

The local Gloucester grounds, Ipswich Bay, Isle of Shoals, Thatchers (fig. 4), and other nearby fishing grounds present roughly the same picture as that of the Nauset area. Red hake predominate, making up about 45 percent of the total, whiting are second in quantity, contributing about 13 percent to the catch. Angler (Lophius americanus) are in third place, making up about 10 percent of the total. Dabs and haddock together make up a consistent but relatively small (about 6 percent) contribution to the total catch.

Table 3 - Catch per Hour of Trawl Industrial Fish, Round Whiting, and Other Food Fish by the Gloucester Fleet on Nauset Grounds. Data for 1956 and 1957 are Combined

Month	No. of Trips	Catch Per Hour			Average Catch per Trip and Percentage of Total Trip					
		Industrial	Round Whiting	All Other Food Species	Industrial		Round Whiting		All Other Food Species	
		(Pounds)			Lbs.	Percent	Lbs.	Percent	Lbs.	Percent
May	34	1,600	1,450	120	30,900	50.4	27,900	45.5	2,500	4.6
June	31	4,080	2,130	100	46,200	64.6	24,200	33.8	1,100	1.6
July	35	7,720	360	240	78,700	92.4	3,700	4.3	2,800	3.3
August	36	4,930	1,170	50	56,600	80.2	13,400	19.0	600	0.9
September	71	3,050	1,590	180	39,000	63.4	20,300	33.0	2,300	3.7
October	26	2,180	1,130	370	31,300	63.2	14,500	29.4	3,700	7.5
November	38	1,440	890	330	24,600	54.4	15,200	33.5	5,500	12.2

Table 2 lists the percentages by weight of all species landed as trawl industrial fish from each of the three areas discussed. These figures are based on all the samples available and are not weighted according to the landings of individual months. They represent only an approximation, therefore, of the actual breakdown in percentage by weight of the landings.

The species composition picture presented for these grounds differs considerably from that of the landings at New Bedford and Pt. Judith (Edwards and Lux 1938). In southern New England waters, red hake are clearly the predominant species for almost the entire year. On the average, they make up over 60 percent of the entire

catch. Whiting rank second, about 20 percent. Little skate (Raja erinacea) and its relatives, big skate (R. ocellata), and the barndoor skate (R. laevis), make up about 10 percent of the total, in sharp contrast to the Gloucester landings.

ABUNDANCE

Adequate interviewing for abundance studies began in Gloucester early in 1956, The interviewers obtained information for each trip, on the number of tows made and the average length of tow. The catch per unit of effort was obtained by simply dividing the landings by the actual number of hours that the net was fishing. The fleet is made up mostly of vessels with an average gross tonnage of about 50 tons, and no corrections were made (or were felt necessary at this stage) for individual boats, actual vessel size, or gear. Since most of the landings come from the Nauset area, the following discussions will be limited to that area.

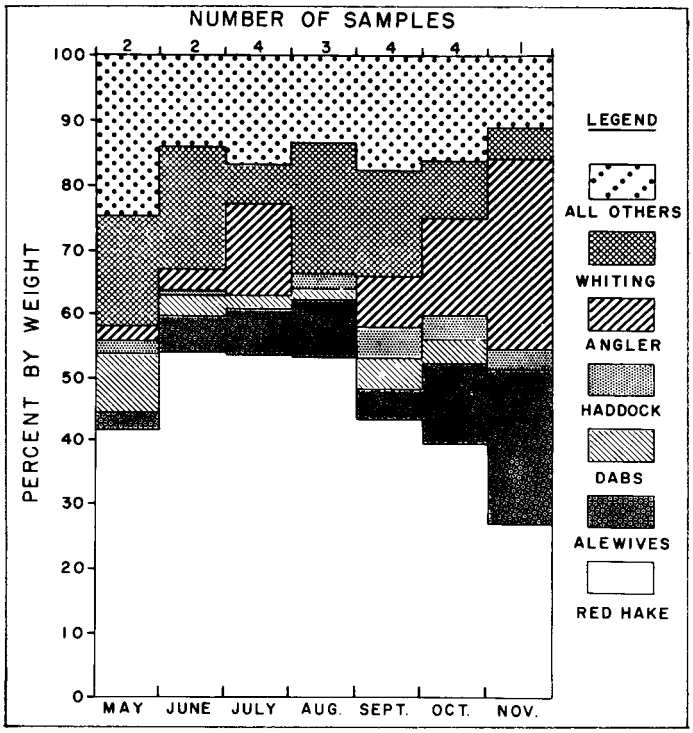


Fig. 4 - Percentage by weight species composition of trawl industrial fish landings at Gloucester from the local Gloucester grounds. Data for 1956 and 1957 have been combined.

Figure 5 shows the seasonal variation in abundance as measured by catch in pounds per hour for the period May through November. All data available for 1956 and 1957 have been combined to elicit the general seasonal pattern. A fisherman may expect to catch about 4,000 pounds per hour in May, with the catch increasing rapidly to over 8,000 pounds per hour in July. The decline in August and early September to about 6,000 pounds per hour is followed by a low level of 2,500 pounds per hour in October and November.

Figure 6 demonstrates that two species, red hake and whiting, account for most of the significant changes observed. The changes in the abundance of red hake are marked and reflect all of the general changes in figure 5. Red hake reach their peak of abundance in July (fig. 6), when the average vessel catch is about 5,000 pounds an hour. Whiting catches of over 3,000 pounds an hour were made in June. In general, whiting are present at levels of at least 1,000 pounds an hour, usually more.

The graph of the catch per hour of whiting (fig. 6) includes both the fish landed for reduction and as human food. Figure 6 also demonstrates that the proportion of whiting landed for reduction is directly related to the abundance of red hake rather than to the whiting's own level of abundance. In figure 6 the industrial portion of the whiting catch expressed in percentage of the total whiting catch is plotted against the catch per hour of red hake. As the catch of red hake increases, it is easier to get a full boatland more quickly, and a fisherman needs to do less culling of fish of higher value to have a successful trip. When "trash fish" are abundant a good trip can be made very quickly. Apparently, the price differential is not sufficient to make it worthwhile for the fishermen to cull out the whiting intensively for the food market under these conditions.

The over-all picture of the Nauset landings is summarized in table 3. Here listed are the statistics on the various portions of the catch for the months of May

Table 4 - Landings of Food Fish by the Gloucester Whiting-Industrial Fish Fleet in September 1956. Total Quantity Landed, Catch Per Hour, and Average Catch Per Trip of Food Species (by Market Category)

Species	Sept. 1-10, 15 Trips, 195.5 Hours Fishing			Sept. 1-10, 24 Trips, 299.5 Hours Fishing			Sept. 21-30, 15 Trips, 242 Hours Fishing			Totals for Month, 54 Trips, 737 Hours Fishing		
	Total Landings	Catch per Hour	Trip Average	Total Landings	Catch per Hour	Trip Average	Total Landings	Catch per Hour	Trip Average	Total Landings	Catch per Hour	Trip Average
	(Pounds)			(Pounds)			(Pounds)			(Pounds)		
Round whiting	148,900	761.6	9,900.0	734,200	2,364.5	30,600.0	357,000	1,477.3	23,800.0	1,240,600	1,683.3	21,700.0
Cod:												
Large	400	2.05	26.7	580	1.9	2.4	360	1.49	24.0	1,340	1.82	24.8
Market	2,675	13.68	178.4	2,425	8.10	101.0	1,850	7.64	123.3	6,950	9.43	128.7
Haddock:												
Large	1,720	8.80	114.7	7,218	24.10	300.8	12,865	53.16	857.7	21,803	29.58	403.8
Scrod	5,650	28.90	376.7	16,205	53.50	675.2	34,265	141.59	2,284.3	56,120	76.15	1,039.3
White hake:												
Large	315	1.61	21.0	30	0.10	1.2	-	-	-	345	0.47	6.4
Market	990	5.06	66.0	2,810	9.38	117.1	2,800	11.57	186.7	6,600	8.96	122.2
Pollock	1,355	6.93	90.3	2,810	9.38	117.1	3,125	12.91	208.3	6,660	9.04	123.3
Gray sole	-	-	-	330	1.10	13.8	3,470	14.34	231.3	3,800	5.16	70.4
Dabs	10	0.05	0.7	560	1.87	23.3	485	2.00	32.3	1,055	1.43	19.5
Yellowtail	125	0.64	8.3	-	-	-	-	-	-	125	0.17	2.3
Butterfish	-	-	-	600	2.00	25.0	250	1.03	16.7	850	1.15	15.7

through November. It should be noted that the number of trips is not the total number made during this period but represents only those trips for which adequate interview data were available to perform the analysis.

FOOD-FISH LANDINGS

The month of September 1956 has been chosen to illustrate the nature of the food-fish landings from the Nauset grounds because of an abundance of data and because they illustrate some important problems associated with this fishery. The

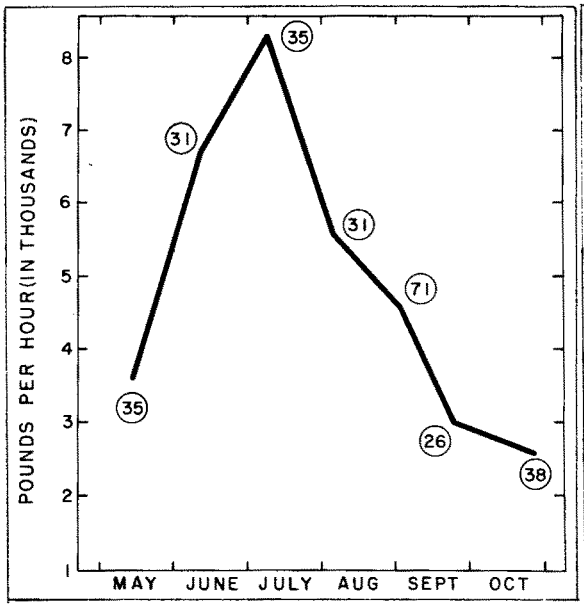


Fig. 5 - Catch per hour of all species on the Nauset grounds for May through November. Number of interviewed trips for each period is circled. Data for 1956 and 1957 have been combined.

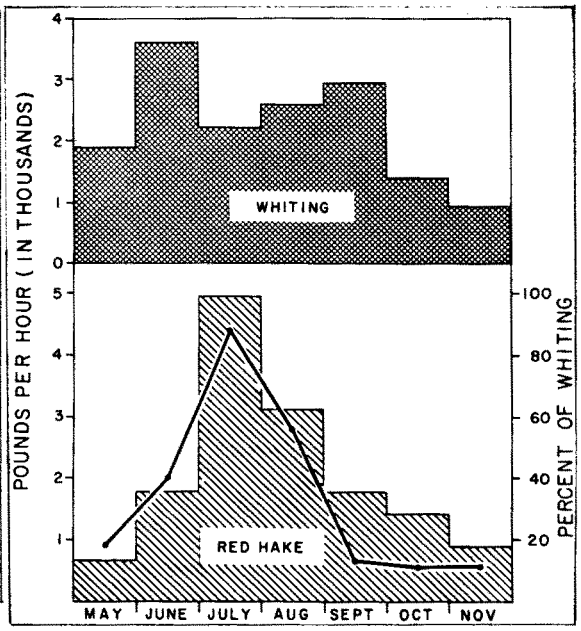


Fig. 6 - Catch in pounds per hour of red hake and whiting in Gloucester landings from the Nauset area. Whiting data are based on the amount landed for reduction plus that landed as food. Data are for May through November. Data for 1956 and 1957 have been combined. Superimposed on the red hake histogram is the graph of the percentage of the total whiting catch sold for reduction.

data were broken down into three periods and are summarized in table 4. The average boat, aside from its industrial catch, lands more whiting than anything else. Various gadoids, haddock, cod, white hake, and pollock make up most of the rest of the food-fish hails. Flounders make up only a small percentage of the total.

Landings of both market categories of cod--large and market--decreased during September 1956. The average monthly catch per hour was 9.43 pounds for market, decreasing from 13.68 pounds for the first ten days to 7.64 pounds for the last ten days of the month. While landings of large white hake in September 1956 decreased from a catch per hour of 1.61 pounds to nothing, market hake substantially increased, in fact landings doubled from the first to the last period. A curious fact worthy of further study is the similarity between the catches per hour of the white hake and the pollock. The gray sole and dab catches both substantially increased, while yellowtail flounder was captured only during the first 10-day period.

The amount of whiting landed for reduction by the trawl industrial fleet at Gloucester is directly related to the abundance of red hake rather than to the abundance of whiting itself. This situation is probably caused by the relatively small price differential between whiting and industrial fish.

The trawl industrial fishery also lands various groundfish for the food market, including haddock, cod, white hake, pollock, dab, yellowtail, and gray sole.

Only small percentages of valuable food species are going to the reduction plants at this time. An expansion of Gloucester's trawl industrial fishery should be possible without foreseeable undue impact on the stocks of valuable food species, considering present practices. The whiting is a possible exception to this since it is in demand for both food and reduction.

The data for haddock are particularly interesting, the catch per hour increasing markedly for both categories. During the last 10-day period the average trip of the two market categories of haddock combined was in excess of 3,000 pounds, in contrast to only 500 pounds during the first 10 days.

LITERATURE CITED

Edwards, Robert L. and Lux, Fred E.
1958. New England's Industrial Fishery. Commercial Fisheries Review, vol. 20, No.5 (May), pp. 1-6. (Also Separate No. 509.)

CRUISE SCHEDULES AND CRUISE RECORDS

This report contains the cruise schedules of the Albatross III (1948 - 1959), Delaware (1951, 1959, 1960), T - 79 (1956 - 1958), and commercial charters (1952 - 1959).

All the data available from each cruise are tabulated on a check list.

Prepared by:

Samuel R. Nickerson

Marine Technician

SCHEDULE OF ALBATROSS III CRUISES
Numbers 1-128, May 1948 to Feb. 19, 1959

Cruise No.	Dates	Purpose of Cruise and Area Covered	Chief of Party
1	May 17-20	Study of effects of waste disposal off New York (National Research Council contract)	Royce
2	May 25-27	Tagging yellowtail flounders north along Cape Cod and in Cape Cod Bay	Royce
3	June 7-10	To test, by tagging, survival of haddock which pass through meshes of savings cod end. Georges Bank	Webster
4	June 21-29	To test, by tagging, survival of haddock which pass through meshes of savings cod end and to compare efficiency of a standard commercial otter trawl with rollers and V-D gear and a modified trawl without rollers and V-D gear. Georges Bank	Webster
5	July 13-21	Census of groundfish populations on Georges Bank	Royce
6	July 28-Aug. 5	Census of groundfish populations on southern New England banks and to test new oceanographic instruments with cooperating WHOI scientists	Royce
7	Aug. 5-25	Census of groundfish populations on Georges Bank	Webster
8	September 1	Demonstration Cruise, Woods Hole	
9	Sept. 8-10	Census of groundfish populations in South Channel area and experiments on the refrigeration of fish at sea	Webster
10	Sept. 29-Oct. 6	Census of groundfish populations in South Channel area	Webster

Cruise No.	Dates	Purpose of Cruise and Area Covered	Chief of Party
	1948		
11	Oct. 14-19	Census of groundfish populations in South Channel area	Webster
12	Oct. 28-Nov. 6	Census of groundfish populations on the southern New England banks, tests of hydrographic gear by WHOI personnel, continuation of the study of the effect of waste acid disposal off New York City	Royce
13	Nov. 18-19	To test action of double-trousered trawl and to compare size selectivity of 4-5/8" stretched mesh and regular commercial mesh. Western side of South Channel	Stringer
14	Dec. 1-9	Census of groundfish populations in the west central part of the Gulf of Maine	Webster
	1949		
15	Jan. 10-13	To test action of double-trousered trawl and to undertake mesh selectivity experiments. Western side of South Channel	Stringer
16	Jan. 17-19	To test action of double-trousered trawl and to undertake mesh selectivity experiments. Western side of South Channel	Stringer
17	Feb. 28	To measure horizontal and vertical of census net. Falmouth outer harbor	Royce
18	May 17-21	To determine distribution of temperature, salinity, and density between Cape Hatteras and Cape Lookout (Cooperative agreement with the Univ. of North Carolina Institute of Fisheries Research)	Royce
19	May 24-June 3	Census of groundfish populations and hydrographic survey of area between Cape Lookout and Cape Fear (Cooperative agreement with the Univ. of North Carolina Institute of Fisheries Research)	Buller

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1949		
20	June 7	Demonstration cruise out of Moorhead City, N. C.	
21	June 8-12	To determine the distribution of shrimp eggs and larvae and fish and make a hydrographic survey in the area between Cape Lookout and Cape Fear	Royce
22	June 14-17	Census of groundfish populations and hydrographic survey area between Cape Lookout and Cape Hatteras	Royce
23	June 23-29	Mesh selectivity studies and tagging experiments on Georges and Browns Banks	Schuck
24	July 11-19	Mesh selectivity studies and underwater camera experiments by WHOI personnel. Georges Bank and South Channel	Stringer
25	July 25	Demonstration Cruise	
26	July 27-Aug. 5	Census of groundfish populations on Georges Bank	Buller
27	Aug. 11-15	Census of groundfish populations, South Channel, Cape Cod Bay, and southern New England banks	Buller
28	Sept. 7-16	Census of groundfish populations in the Gulf of Maine	Buller
29	Sept. 23-29	Mesh selectivity experiments on haddock and redfish. Georges Bank and Gulf of Maine	Stringer
	1950		
30	Jan. 4-13	Hydrographic survey of continental shelf between Long Island, N. Y., and Little River Inlet, N. C. (In cooperation with WHOI and Univ. of North Carolina)	Royce

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1950		
31A	Jan. 16-24	To determine trawlability of bottom and availability of food fish on the continental shelf between Cape Fear and Cape Lookout (Cooperative Agreement with the Univ. of North Carolina)	Buller
31B	Jan. 16-24		Buller
31C	Feb. 6-12		Arnold
31D	Feb. 25-Mar. 6		Arnold
32	Feb. 25-Mar. 6	Hydrographic survey of area between Little River Inlet and Oregon Inlet (Cooperative agreement with the Univ. of North Carolina)	Arnold
33	Mar. 15-30	Census of groundfish populations on Georges Bank	Buller
34	Apr. 24-May 5	Exploratory fishing and census of groundfish populations on the western Nova Scotian Banks	Royce
35	May 11-18	Census of groundfish populations with special study of fluke and yellowtail flounders near the continental edge of Southern New England. (Cooperative project with WHOI)	Schroeder
36	June 6-23	"Operation Cabot" Gulf Stream Study (Cooperative project, U. S. Navy, WHOI, Canadian Research Establishment, FWS, Scripps Inst. of Oceanog.)	Colton
37	July 6-12	Census of groundfish populations on Georges Bank	Royce
37A	July 31-Aug. 10	Census of groundfish populations on Georges Bank, Browns Bank, and the Gulf of Maine	Buller
38	Aug. 21-31	Census of groundfish populations, South Channel and Southern New England banks. Studies of the gas content in the swim bladder (WHOI personnel)	Buller
39	Sept. 6-15	Tagging of scrod and large-sized haddock on Georges and western Nova Scotian Banks	Schuck

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
40-44	Feb. 9, 1951 to June 25, 1952	Operating under ONR contract for WHOI (Jezebel Program #8961)	
	June 1952 to Feb. 1953	Jezebel Program #8961 (operating out of Bayonne, N. J.; to Bermuda, Morehead City, N. C.	
	1953		
45	Mar. 3-11	To study vertical and horizontal distribution of redfish in the Gulf of Maine	Kelly
46	Mar. 19-Apr. 2	To determine the distribution of haddock eggs and larvae, temperature, and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank Area	Colton
47A	Apr. 9-13	To determine the characteristics of a fish school: area, density, and relation to the bottom, Georges Bank	Taylor
47B	Apr. 15-21	------do---------	Taylor
48	Apr. 24-May 6	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
49	May 14-21	Mesh selectivity experiments on haddock. Southeast and southwest parts of Georges Bank	Clark
50	May 25-June 3	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
51	June 8-17	Mesh selectivity experiments on haddock. Vicinity of Jeffries Ledge, Gulf of Maine; Southeast part of Georges Bank	Clark
52	July 20-29	Mesh selectivity experiments on haddock. Southeast and southwest parts of Georges Bank	Clark

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1953		
53	Aug. 10-21	Studies of the distribution of redfish in the Gulf of Maine, southern edge of Georges Bank and Nantucket Shoals	Kelly
54	Sept. 1-14	Studies of the distribution of pre-recruit haddock in the Gulf of Maine-Georges Bank area	Colton
55	Sept. 22-25	Studies of the distribution of pre-recruit haddock on the Southern New England Banks	Colton
	Sept. 26, 1953 to Jan. 31, 1955	Laid up for lack of funds	
	1955		
56	Feb. 1-13	Studies of the distribution of groundfish on Georges Bank	Clark
57	Feb. 21-Mar. 9	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
58	Mar. 19-Apr. 1	-------do----------	Colton
59	April 6-12	Mesh selectivity studies LaHave Bank	Clark
60	April 19-May 3	To determine the distribution of haddock eggs and larvae, temperature and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Marak
61	May 16-28	------ do ----------	Colton
62	June 6-18	Studies of the distribution of groundfish on Georges and Browns Banks	Clark
63	Aug. 15-19	Studies of the horizontal and vertical distribution of redfish in the Gulf of Maine and South Channel	Kelly
64	Aug. 23-Sept. 2	Mesh selectivity studies. Sable Island	Clark

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1955		
65	Sept. 7-16	Studies of the distribution of prerecruit haddock in the Gulf of Maine-Georges Bank area	Colton
66	Sept. 21-28	Studies of the distribution of prerecruit haddock on Georges and the southern New England banks	Colton
67	Oct. 3-5	Experiment with 6 types of bottom samplers. South of Martha's Vineyard	Wigley
68	Oct. 12-28	Mesh selectivity studies. Joint cruise with Delaware. Georges Bank	Clark
69	Nov. 15-23	Bottom survey to sample benthic fauna on southern part of Georges Bank and Nantucket Shoals.	Wigley
70	Dec. 6-19	Bottom survey of benthic fauna and to tag scallops on southern part of Georges Bank and Nantucket Shoals	Wigley
	1956		
71	Feb. 20-Mar. 2	To determine the distribution of haddock eggs and larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Marak
72	Mar. 21-31	---------do---------	Colton
73	April 17-28	---------do---------	Colton
74	May 2-10	Mesh selectivity studies, Georges Bank	Clark
75	May 16-29	To determine the distribution of haddock eggs and larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine-Georges Bank area	Colton
76	June 11-24	---------do---------	Marak
77	July 5-11	Survey of sea scallop beds on Georges Bank	Posgay

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1956		
78	July 16-17	Underwater TV testing, Buzzards Bay	Clark
79	July 23-Aug. 4	Mesh selectivity studies with Delaware (#23), Georges Bank	Clark
80	Aug. 9-17	Bottom survey of benthic fauna on Georges Bank	Wigley
81	Nov. 2-10	Studies of the distribution of pre-recruit haddock and whiting in the Gulf of Maine-Georges Bank area and the southern New England banks	Conover
82	Nov. 13-21	---------do---------	Conover
83	Nov. 27-30	Studies of the behavior and escapement of fish through the cod end of a commercial otter trawl with UTV. Provincetown, Cape Cod Bay, and No Man's	Livingstone
84	Dec. 6-14	Codfish and haddock tagging. Georges Bank	Wise
85	Dec. 19-20	Comparison of SMBA (CPS Emitron) and USFWS (Image-Orthicon) UTV equipment. Vicinity of Woods Hole	Livingstone
	1957		
86	Jan. 21-23	Studies of the mid-water distribution of red hake in respect to depth and temperature. South of Martha's Vineyard	Edwards
87	Jan. 30-Feb. 2	To study the behavior of trawl-caught haddock with UTV. Georges Bank	Livingstone
88	Feb. 19-28	To determine the distribution of herring larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine, Georges Bank and Bay of Fundy area	Farrin
89	Mar. 21-Apr. 5	To test the efficiency of various tags to tag cod, and study groundfish behavior with UTV. Georges Bank, Browns Bank	Livingstone
90	April 11-17	To study in detail the nontidal drift pattern on Georges Bank with relation to the drift of haddock eggs and larvae	Colton

Cruise No.	Date 1957	Purpose of Cruise and Area Covered	Chief of Party
91	Apr. 22-23	To test and calibrate 60lb multiplane kite-otter. South of Martha's Vineyard	Colton
92	Apr. 25-May 2	To study in detail the nontidal drift pattern on Georges Bank with relation to the drift of haddock eggs and larvae	Colton
93	May 8-16	---------do---------	Marak
94	May 22-29	---------do---------	Colton
95	June 5-12	---------do---------	Colton
96	June 19-26	Study of the behavior of fish with UTV Cape Cod Bay and South Channel	Livingstone
97	July 10-13	To study the behavior of whiting in trawls with UTV, South Channel	Clark
98	July 14-19	Silver hake tagging northwest of the Cultivator whistle buoy	Fritz
99	July 25-Aug. 2	Vertical distribution of redfish and haddock fry in the Gulf of Maine	Kelly
100	Aug. 15	Demonstration Cruise out of Boston	
101	Aug. 21-30	Bottom survey of benthic fauna on Georges Bank, South Channel and Browns Bank	Wigley
102	Sept. 5-11	Vertical distribution of postlarval redfish in Gulf of Maine	Kelly
103	Sept. 18-26	Dredging, tagging, and observing spawning of sea scallops, Georges Bank	Posgay
104	Oct. 9-20	Haddock and cod tagging on Georges and Browns Banks	Jensen
105	Oct. 28-Nov. 8	Haddock and cod tagging in the Gulf of Maine and on Browns Bank	Wise
106	Dec. 3-20	To determine the distribution of herring larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine, Georges Bank and Bay of Fundy area	Temple

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1958		
107	Jan. 7-24	To determine the distribution of herring larvae, temp. and salinity; and the general circulation pattern in the Gulf of Maine, Georges Bank and Bay of Fundy area	Temple
108	Mar. 26-Apr. 9	To tag haddock and occupy IGY hydrographic section, Georges and Browns Banks	Jensen
109	Apr. 21-25	To study the behavior of fish and use of UTV for estimating population sizes of fish. Cape Cod fishing grounds	Livingstone
110	Apr. 30-May 8	Testing new high-speed sampler and calibration trials of multiplane kite-otter. Georges Bank	Marak
111	May 19-28	To study vertical distribution of fish eggs and larvae. Georges Bank	Colton
112	June 9-13	Studies of the behavior and orientation of groundfish with UTV. Stellwagen Bank and Massachusetts Bay	Livingstone
113	June 19-26	Sea scallop tagging and bottom photography. Georges Bank	Posgay
114	July 7-16	Whiting tagging. Georges Bank and New England Coast.	Fritz
115	July 23	Demonstration Cruise out of Boston Stellwagen Bank	
116	Jul. 28-Aug. 1	Study the vertical distribution of post-larval redfish in the southwest part of the Gulf of Maine.	Kelly
117	Sept. 9-16	Study the vertical distribution of redfish and occupy IGY hydrographic section. Georges Bank, Browns Bank, and southwest part of Gulf of Maine	Kelly
118	Sept. 22-Oct. 2	Studies of the distribution of prerecruit haddock in the Gulf of Maine-Georges Bank area	Colton
119	Oct. 6-17	Studies of the distribution of prerecruit haddock on Georges Bank	Marak

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1958		
120	Oct. 20-28	Studies of the distribution of prerecruit haddock on the southern New England banks	Colton
121	Nov. 4-7	To test current and temperature instrumentation used in conjunction with UTV. Cape Cod Bay	Livingstone
122	Nov. 17-26	Haddock tagging and populations studies on the Highland Grounds east of Stellwagen Bank and Cape Cod	Clark
123	Dec. 4-11	Sampling silver hake and yellowtail flounder south of Martha's Vineyard and off Nauset Light and Bell Telephone exercise	Fritz
124A	Dec. 13	To test high-speed plankton sampler. Southeast of Block Island	Miller
124B	Dec. 16-17	To test bottom fauna sampler and evaluate efficiency of the naturalist's dredge. Vineyard Sound and Buzzards Bay	Wigley
	1959		
125	Jan. 13-15	Industrial fish survey off Block Island Sound	Fritz
126	Jan. 21-Feb. 4	To study the role of temperature in fish distribution. Cape Cod to Cape Hatteras	Edwards
127	Feb. 10-11	To recover recording buoy on Georges Bank	Hiller
128	Feb. 15-20	Bell Telephone Laboratory Exercise	Hiller
	Feb. 27	Departed Woods Hole for East Boston for lay up.	

SCHEDULE OF DELAWARE CRUISES

Fiscal Years 1959 and 1960

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1959		
59-3	Mar. 18-27	To catch yellowtail flounder for tagging. South of Martha's Vineyard to south of Block Island	Lux
59-4	Apr. 2-17	To determine vertical distribution of spawning haddock. Browns shoals	Clark
59-9	Aug. 6-12	Obtaining samples of substrates for benthic fauna. Southern Gulf of Maine and Browns Bank	Wigley
59-12	Sept. 23-Oct. 7	Studying the distribution of young-of-year and older haddock. Browns and Georges Banks, and the Gulf of Maine	Wise
59-13	Oct. 13-27	Studying the distribution of young-of-year and older haddock. Browns and Georges Banks, Gulf of Maine and the offing of New York	Jensen
59-14	Dec. 1-10	Survey techniques. Southeast of Martha's Vineyard	Fritz
	1960		
60-2	Feb. 10-29	Conduct hydrographic and fishing survey. Continental Shelf from Martha's Vineyard to Cape Hatteras	Fritz
60-3	Mar. 8-19	Conduct a fishing survey and determine the vertical movements of the silver and American hake. Continental Shelf along the eastern side of Georges Bank	Skerry
60-4	Mar. 23-Apr. 3	Conduct a survey of the spawning habits of haddock. Georges and Browns Banks	Wise
60-5	Apr. 6-12	To collect adult haddock and haddock eggs and to make designated bathythermograph transects. Georges and Browns Banks	Wheeler
60-7	May 11-22	Survey techniques. South of Block Island to Cape Hatteras	Merrill
60-8	May 23-29	To compile data relating to the population structure and density of the sea scallop beds. Georges Bank	Posgay

SCHEDULE OF DELAWARE CRUISES

Fiscal Years 1959 and 1960

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1960		
60-10	July 5-9	This cruise, the first of a series, is a survey of the inshore distribution and the possible incidental take of young-of-the-year and 1-year-old haddock by the whiting and industrial fishing fleets. Area between Cape Ann and Isles of Shoals, Stellwagen Bank, and area off Nauset Beach.	Fritz
60-12	May 2-21	To determine the distribution and relative abundance of young-of-the-year haddock and other fishes occurring in the Gulf of Maine, Georges Bank, and Browns Bank	Skerry
	1961		
61-4	Mar. 16-27	To investigate the vertical movements of silver and American hake east of Delaware Bay	Fritz
61-5	Mar. 30-Apr. 7	To tag fluke in an area between Veatch and Hudson Canyons in 50 to 80 fathoms of water	Lux
61-7	May 3-10	To collect quantitative length-frequency samples of the sea scallop population. Georges Bank	Merrill
61-9	June 12-16	Inshore haddock survey between Isles of Shoals, Stellwagen Bank, and Nauset	Fritz
61-10	June 20-30	Obtain samples of bottom sediments and benthic fauna. Central and northern portions of the Gulf of Maine	Wigley
61-12	July 20-Aug. 3	To conduct whiting selection experiments. Ipswich Bay, Stellwagen Bank, Nauset	Fritz
61-13	Aug. 10-19	To perform scallop gear selection experiments. Georges Bank	Merrill

Cruise No.	Date	Purpose of Cruise and Area Covered	Chief of Party
	1961		
61-16	Sept. 22-30	To collect data on abundance and distribution of sea scallops. Georges Bank	Posgay
61-17	Oct. 3-6	To conduct a groundfish survey on the northern edge at Georges Bank	Fritz
61-19	Oct. 25-Nov. 6 Nov. 8 -20	To determine distribution and abundance of young-of-the-year haddock and other fishes from Bay of Fundy south to Hudson Canyon.	Fritz Miller
	1962		
62-3	Mar. 15-22	To conduct a serological survey at selected stations from Massachusetts Bay to Browns Bank via Nauset and Georges Bank	Cumming
62-6	May 28-June 6	To collect data on the distribution and abundance of sea scallops. Georges Bank	Merrill
62-7	June 11-20	To sample the benthic fauna and bottom sediments at designated localities in Great South Channel, Georges Bank, and the region south of Nantucket and Marthas Vineyard	Wigley
62-8	June 25-28	Collect live specimens of the common offshore species for aquarium exhibits. To make a groundfish survey south of Marthas Vineyard.	Wheeler Fritz
62-10	Sept. 11-20	To collect data on distribution and abundance of sea scallops on Georges Bank	Merrill
62-12	Oct. 9-20	To determine distribution and abundance of young-of-the-year haddock and other fishes from the Bay of Fundy southward to Hudson Canyon.	Fritz
62-13	Oct. 25-Nov. 4	- - - - - - do - - - - - - - - - -	Jensen

CRUISE RECORDS

Cruise No.	Sailing Order	Supplement	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Albatross III									
1	X	X	X	O	X	X	O	O	O
2	X	X	X	O	X	X	O	O	O
3	X	X	O	O	X	X	O	O	O
4	X	X	X	O	X	X	O	O	O
5	X	X	X	O	X	X	O	O	X
6	X	X	X	O	X	X	O	O	X
7	X	X	X	O	X	X	O	O	X
8	X	X	X	O	Dem. Cr.	O	O	O	O
9	X	X	X	O	X	O	O	O	X
10	X	X	X	O	X	X	O	O	O
11	X	X	X	O	X	X	O	O	X
12	X	X	X	X	X	X	O	O	X
13	X	X	X	O	X	O	O	O	X
14	X	X	X	O	X	O	O	O	X
15	X	X	X	X	X	O	O	O	X
16	X	X	X	X	X	O	O	O	X
17	X	X	O	O	O	O	O	O	O
18	X	X	X	X	X	WHOI	X	O	O
19	X	X	X	O	X	WHOI	X	O	O
20	X	X	X	O	Dem. Cr.	WHOI	X	O	O
21	X	X	X	O	X	WHOI	X	O	O
22	X	X	X	O	X	WHOI	X	O	O
23	X	X	X	O	X	WHOI	X	O	X
24	X	X	X	O	X	O	O	O	O
25	X	X	X	O	Dem. Cr.	O	O	O	O
26	X	X	X	O	X	X	X	O	X
27	X	X	X	O	X	X	X	O	X
28	X	X	X	O	X	X	X	O	X
29	X	X	X	O	X	O	O	O	O
30	O	X	O	O	O	WHOI	X	O	O
31A	X	X	X	O	X	WHOI	X	O	O
31B	X	X	X	O	X	WHOI	X	O	O
31C	X	X	X	O	X	WHOI	X	O	O
31D	X	X	X	O	X	WHOI	O	O	O
32	X	X	X	O	O	WHOI	X	O	O
33	X	X	X	O	X	X	X	O	O
34	X	X	X	O	X	X	O	O	O
35	X	X	X	O	X	X	X	O	O
36	X	X	X	O	O	X	O	O	O
37	X	X	X	O	X	X	O	O	O
37A	X	X	O	O	X	X	X	O	O
38	X	X	X	O	X	X	X	O	O
39	X	X	X	O	X	O	O	O	O
Delaware									
1	X	X	X	O	O	O	O	O	O
2	X	X	X	O	X	X	O	O	O
3	X	X	X	O	X	X	O	O	O

CRUISE RECORDS (Continued)

Cruise No.	Sailing Order	Supplement	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Albatross III									
40-44	Operating for WHOI					WHOI			
45	X	X	X	O	X	X	O	O	O
46	X	X	X	X	O	X	O	O	O
47A	X	X	X	X	O	X	O	O	O
47B	X	X	X	X	O	X	O	O	O
48	X	X	X	O	O	X	O	O	O
49	X	X	X	O	O	X	O	O	O
50	X	X	X	O	O	X	O	O	O
51	X	O	X	O	O	WHOI	O	O	O
51A	O	O	O	O	X	WHOI	O	O	O
52	X	O	X	O	O	WHOI	O	O	O
53	X	X	X	O	X	WHOI	O	O	O
54	X	X	X	O	X	X	O	O	O
55	X	X	X	O	X	X	O	O	O
56	X	X	X	O	X	X	O	O	O
57	X	X	X	O	O	X	O	O	O
58	X	X	X	O	O	X	O	O	O
59	X	X	X	O	O	O	O	O	O
60	X	X	X	O	O	X	O	O	O
61	X	X	X	O	O	X	O	O	O
62	X	X	X	O	X	X	O	O	O
63	X	X	X	O	X	X	O	O	O
64	X	X	X	O	O	O	O	O	O
65	X	X	X	O	X	X	O	O	O
66	X	X	X	O	X	X	O	O	O
67	X	X	X	O	O	O	O	O	O
68	X	X	X	O	O	O	O	O	O
69	X	X	X	O	O	X	O	O	O
70	X	X	X	O	O	X	O	O	O
71	X	X	X	O	O	X	O	O	O
72	X	X	X	O	O	X	O	O	O
73	X	X	X	O	O	X	O	O	O
74	X	X	X	O	O	O	O	O	O
75	X	X	X	O	O	X	O	O	O
76	X	X	X	O	O	X	O	O	O
77	X	X	X	O	O	X	O	O	O
78	X	O	X	O	O	O	O	O	O
79	X	X	X	O	O	O	O	O	O
80	X	X	X	O	O	X	O	O	O
81	X	X	X	O	X	X	O	O	O
82	X	X	X	O	X	X	O	O	O
83	X	O	X	O	O	O	O	O	X
84	X	O	X	O	O	O	O	O	X
85	X	O	X	O	O	O	O	O	O
86	X	O	X	O	O	X	O	O	X
87	X	X	X	O	O	X	O	O	O
88	X	X	X	O	O	X	O	O	X
89	X	X	X	O	X	X	O	O	X
90	X	X	X	O	O	X	O	O	O

CRUISE RECORDS (Continued)

Cruise No.	Sailing Order	Supplement	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Albatross III									
91	X	X	X	O	O	X	O	O	O
92	X	X	X	X	O	X	O	O	O
93	X	X	X	O	O	X	O	O	O
94	X	X	X	O	O	X	O	O	O
95	X	X	X	O	O	X	O	O	O
96	X	O	X	O	O	O	O	O	O
97	X	O	X	O	O	O	O	O	X
98	X	O	X	O	O	O	O	O	X
99	X	X	X	O	X	X	O	O	X
100	X	X	X	O	Dem. Cr.	O	O	O	O
101	X	O	X	O	O	O	O	O	O
102	X	X	X	O	X	X	O	O	O
103	X	O	X	O	O	X	O	O	O
104	X	X	X	O	X	X	O	O	O
105	X	X	X	O	X	X	O	O	O
106	X	X	X	O	O	X	O	O	O
107	X	X	X	X	O	X	O	O	O
108	X	X	X	O	X	X	O	O	O
109	X	X	X	X	O	X	O	O	O
110	X	X	X	O	O	X	O	O	O
111	X	X	X	O	O	X	O	O	O
112	X	X	X	O	O	X	O	O	O
113	X	X	X	O	O	X	O	O	O
114	X	X	X	O	X	X	O	O	X
115	X	X	X	O	Dem. Cr.	O	O	O	O
116	X	X	X	O	X	X	O	O	X
117	X	X	X	O	X	X	O	O	X
118	X	X	O	X	X	X	O	O	X
119	X	X	O	X	X	X	O	O	X
120	X	X	O	X	X	X	O	O	X
121	X	X	X	O	O	X	O	O	X
122	X	X	X	O	O	X	O	O	O
123	X	X	X	O	X	X	O	O	O
124	X	O	X	O	O	O	O	O	O
125	X	X	X	O	X	X	O	O	O
126	X	X	X	O	X	X	O	O	X
127	X	O	O	O	O	X	O	O	O
128	X	X	O	O	O	X	O	O	O
Delaware									
59-3	X	X	X	O	O	X	O	O	O
59-4	X	X	O	O	O	X	O	O	O
59-9	X	O	X	O	O	X	O	O	O
59-12	X	X	X	O	X	X	O	O	O
59-13	X	X	X	O	X	X	O	O	O
59-14	X	X	X	X	X	X	O	O	O

CRUISE RECORDS (Continued)

Cruise No.	Sailing Order	Supplement	Cruise Report	Press Release	Trawl Cards	B. T. Cards	Loran Logs	Admin. Supp.	Bottom Trace
Delaware									
60-2	X	X	X	O	X	X	O	O	O
60-3	X	X	X	O	X	X	O	O	O
60-4	X	X	X	O	X	X	O	O	O
60-5	X	O	X	O	X	X	O	O	O
60-7	X	X	X	O	O	X	O	O	O
60-8	X	X	X	O	O	X	O	O	O
60-10	X	X	X	X	X	X	O	X	X

Key: X = Available; O = Missing.

Cruise Schedule for

COMMERCIAL CHARTERS AND T-79

Vessel	Dates	Purpose	Chief of Party
	1952		
We Three	May 6	To sample small redfish with a Petersen small fish trawl, a line trawl, and a gill net in the area East of Cape Porpoise in 60 fathoms	Kelly
Michigan	June 4-12	To determine the selectivity of sizes of haddock by an otter trawl of various mesh sizes. Georges Bank	Clark
Michigan	June 15-23	- - - - - do - - - - - - - -	Clark
U.S. Fish & Wildlife Launch	Sept. 10-12	To fish experimentally for small redfish and handline for large redfish in the deep water off Gloucester harbor	Kelly
Caryn	Oct. 2-3	To trawl with a fine mesh net (1/4" square) for scattering layer organisms and for young redfish. South of Marthas Vineyard, 70-100 fathoms	Kelly
Wisconsin	Oct. 14-23	To determine the selectivity of sizes of haddock by an otter trawl of various mesh sizes. Georges Bank	Clark
	1953		
Cap'n Bill II	July 10-17	Exploratory fishing on the edge of the Continental Shelf to determine the fauna present in the 200 fathom to 700 fathom depths. Block Island to Corsair Canyon	W. Schroeder
Priscilla V 1	Nov. 9-11	To sample young-of-the-year redfish from New Scrantum station 25 miles east of Gloucester for validation of otolith year zones.	Kelly

Vessel	Dates	Purpose	Chief of Party
	1954		
Priscilla V 2	Feb. 5-8	----- do -----	Kelly
Priscilla V 3	Apr. 20-23	----- do -----	Kelly
Priscilla V 4	Aug. 3-10	----- do -----	Kelly
Priscilla V 5	Sept. 13-Nov. 2	Whiting mesh selection Cape Cod Bay and Jeffrey's Ledge	Clark
Priscilla V 6	Nov. 17-23	Redfish mesh selection. Cashes Ledge	Clark
	1955	No charters	
	1956		
Huckleberry Finn William Cheesebrough	Oct. 29-Nov. 1	To observe the behavior of fish while being captured by an otter trawl in the Amagansett area off Long Island, New York	Livingstone
	1957		
Canadian R./V. Harengus	May 15-18	To recapture redfish tagged at Eastport, Maine, between Grand Manan and Campobello Island	Kelly
Whaling 1 City	June 13-23	To test the relative efficiency of scallop dredges with 2", 3", 3 1/2", and 4" rings in the bag and to determine the selection points of the various ring sizes. Cultivator and Northeast Peak	Posgay
Whaling 2 City	Aug. 8-17	To develop gear selection curves for scallop dredges with 3", 3 1/2", and 4" rings. Georges Bank	Posgay
	1958		
Jacquelyn 1	May 21	A series of cruises to obtain periodic data for life history studies of industrial fish and sea scallops around Block Island	Edwards

Vessel	Dates	Purpose	Chief of Party
	1958		
Jacquelyn 2	June 12	- - - - - do - - - - - -	Edwards
Jacquelyn 3	July 18	To sample at the regular fishing and scallop stations.	Merrill
Jacquelyn 4	Aug. 18	To sample at the regular fishing and scallop stations.	Merrill
Jacquelyn 5	Sept. 23	To census scallop and fish populations and to take samples of this material for detailed study at the Woods Hole Laboratory.	Edwards
Dartmouth	Sept. 9-16	To compare selectivity of scallop dredges made of 3, and 3 1/2, and 4 inch rings (inside diameter) with 2 inch I. D. dredge. Census scallop stocks, test metered roller and make spawning observations. Georges Bank	Nichy
	1959		
Whaling 3 City	May 13-20	To collect length frequency and age frequency samples from the Georges Bank sea scallop beds.	Posgay
Whaling 4 City	Sept. 12-18	- - - - - do - - - - - -	Merrill
	1960		
Cap'n 1 Bill III	Aug. 22-26	Inshore haddock survey between Isle of Shoals, Stellwegen Bank, and Nauset	Skerry
Cap'n 2 Bill III	Sept. 19-23	- - - - - do - - - - - -	Skerry
Noah A 1	Sept. 30	To census a scallop population and take samples for analysis at Woods Hole Laboratory. Three miles northwest of Billingsgate Buoy, Cape Cod Bay	Merrill

Vessel	Dates	Purpose	Chief of Party
	1960		
Noah A 2	Oct. 9	To check spawning and bring back unspawned scallops to Laboratory for experiments and to make underwater observations on the efficiency of scallop gear. Three miles northwest of Billingsgate Buoy, Cape Cod Bay	Merrill
Noah A 3	Oct. 23	To check sea scallop spawning, to observe and take underwater motion pictures of the operation of sea scallop gear. Three miles north of Sandy Neck, Cape Cod Bay	Merrill
Noah A 4	Nov. 13	To check spawning, and to perform experiments to determine the efficiency of scallop gear. Three miles northwest of Billingsgate Buoy, Cape Cod Bay	Merrill
	1961		
Charlotte 1	Sept. 1	To locate beds of scallops in sufficient quantities for later experiments on scallop gear efficiency. Two to five miles northwest of Sandwich, Mass.	Merrill
Charlotte 2	Oct. 16	To check the spawning of the sea scallop. Two to five miles northwest of Sandwich, Mass.	Merrill
Charlotte 3	Nov. 14	To check the spawning of the sea scallop. Two to five miles northwest of Sandwich, Mass.	Merrill
	1962		
Charlotte 4	Jan. 16	To obtain live scallops for laboratory tank experiments; to observe gonad development of sea scallops. Two to four miles northwest of Sandwich, Mass.	Haynes
Charlotte 5	April 7	- - - - - do - - - - - -	Haynes

MONTHLY HADDOCK CRUISES

Silver Mink and Shirley-Roland

High Grounds NNE of Cape Cod Light

Cruise No.	Date	Purpose	Chief of Party
1	Feb. 12, 1958	To make observations and collect data for haddock ecology study	Clark
2	Mar. 9, 1958	- - - - - do - - - - - -	Clark
3	Apr. 11, 1958	- - - - - do - - - - - -	Clark
4	May 12, 1958	- - - - - do - - - - - -	Jensen
5	June 8, 1958	- - - - - do - - - - - -	Jensen
6	July 12, 1958	- - - - - do - - - - - -	Jensen
7	Aug. 9, 1958	- - - - - do - - - - - -	Clark
8	Sept. 14, 1958	- - - - - do - - - - - -	Clark
9	Oct. 14, 1958	- - - - - do - - - - - -	Jensen
10	Nov. 13, 1958	- - - - - do - - - - - -	Clark
11	Dec. 11, 1958	- - - - - do - - - - - -	Clark
12	Jan. 15, 1959	- - - - - do - - - - - -	Jensen

T-79 CRUISE SCHEDULE

Cruise No.	Date	Purpose	Chief of Party
	1956		
1	May 25-27	Shake-down cruise to test suitability of T-79 as a fisheries research vessel, to test the fishing gear and hauling equipment and to tag haddock 18 miles southwest of Pollock Rip Lightship.	Clark
2	June 28-July 14	To tag fish in the Gulf of Maine.	Clark
3	August 22	To collect spawning butterfish southeast of No Man's.	Colton
4	August 29	To test trawling gear on the Middle Ground.	Colton
5	August 31	To collect spawning butterfish in an area 10 miles south of No Man's.	Colton
6	Sept. 12-14	1. To sample species composition of fishes on various grounds. 2. To determine diurnal periodicity of feeding habits of the commoner species of fish. 3. To determine the abundance of and the species of the various common bottom organisms, and 4. To tag skates and some other species of fish if they are sufficiently abundant on the grounds fished. Area - Southern New England fishing grounds.	Edwards
7	Oct. 5	To test underwater television equipment under tow in Falmouth Harbor.	Livingstone

Cruise No.	Date	Purpose	Chief of Party
8	Oct. 10-12	To make a hydrographic transect of the "Deep Hole" and to conduct studies into the feeding habits of local fish.	Edwards
9	Oct. 16	To test underwater TV equipment and handling procedures off Naushon Island.	Livingstone
	1957		
10	Feb. 14	To test otter trawl gear and to tag yellowtail flounders about 12 miles south of Cox Ledge in 30 fathoms.	Lux
11	Feb. 25	To tag yellowtail flounders south of No Man's to south of Block Island.	Lux
12	March 12	Investigate fish stocks in Buzzards Bay for the purpose of tagging.	Edwards
13	Mar. 12-14	Hydrographic transect south of Martha's Vineyard and Block Island.	Edwards
14	March 22	Looking for stocks of fish in Buzzards Bay.	Edwards
15	March 26	Test and use underwater camera in Buzzards Bay.	Posgay
16	Sept. 16-20	To tag silver hake two miles west of Race Point, Stellwegen Bank, and Cape Cod Bay.	Fritz
17	Oct. 15-17	To find concentrations of scup for tagging, to test fishing gear; to do some red hake biology in the Block Island area.	Edwards
18	Oct. 30	To sample flounders and industrial species off Nauset Beach in 25-30 fathoms.	Lux
19	Nov. 14-27	To tag haddock and to collect young-of-the-year haddock off Gloucester and Mt. Desert Island, Maine.	Dietsch

Cruise No.	Date	Purpose	Chief of Party
	1958		
20	Jan. 21	To sample yellowtail flounder 25-30 miles southwest of No Man's Land.	Lux
21	Jan. 28-31	Calibration of multiplane kite otter and high-speed plankton sampler off Provincetown and Murray Basin.	Colton
22	Aug. 11	To return vessel T-79 to Army authorities at Army Transportation Depot, Charleston, South Carolina. In charge: Captain Samuel Vincent	

Cruise Records

for

COMMERCIAL CHARTERS AND T-79

Vessel	Sailing Order	Supplement	Cruise Report	Trawl Cards	Logs	BT Cards
We Three	O	X	X	O	O	O
Michigan 1	Original Rough logs		X	X	O	O
Michigan 2	Original Rough logs		X	X	O	O
U.S. FW Launch	O	O	X	X	O	O
Caryn	O	O	X	O	O	O
Wisconsin	Original Rough logs		X	X	O	O
Cap'n Bill II	O	O	X	O	O	O
Priscilla V 1						
Priscilla V 2	Age and Growth of the Redfish in the Gulf of Maine					
Priscilla V 3	Fishery Bulletin 156					
Priscilla V 4						
Priscilla V 5	Original Rough logs		O	O	O	O
Priscilla V 6						
Huckleberry Finn	O	O	X	O	O	O
William Cheesebrough						
Harengus	O	O	X	O	O	O
Whaling City 1	O	O	X	O	O	O
Whaling City 2	O	O	X	O	O	O
Jacquelyn 1	O	O	X	X	O	X
Jacquelyn 2	O	O	X	X	O	X
Jacquelyn 3	O	O	X	X	O	X
Jacquelyn 4	O	O	X	X	O	X
Jacquelyn 5	O	O	X	X	O	X
Dartmouth	X	O	X	O	O	O
Whaling City 3	Z	X	X	O	O	O
Whaling City 4	X	X	X	O	O	X
Silver Mink and Shirley and Roland Cruises						BT Records
1	O	O	X	X	O	X
2	O	O	X	X	O	X
3	O	O	X	X	O	X
4	O	O	X	X	O	X
5	O	O	X	X	O	X
6	O	O	X	X	O	X
7	O	O	X	X	O	X
8	O	O	X	X	O	X
9	O	O	X	X	O	X
10	O	O	X	X	O	X
11	O	O	X	X	O	X
12	O	O	X	X	O	X
T-79 Cruises						
1	O	O	X	O	O	X
2	X	O	X	O	O	O

Cruise Records (Continued)

for

COMMERCIAL CHARTERS AND T-79

Vessel	Sailing Order	Supple-ment	Cruise Report	Trawl Cards	Logs	BT Cards
T-79 Cruises						
3	X	O	X	O	O	O
4	X	O	O	O	O	O
5	X	O	X	O	O	O
6	X	X	X	O	O	O
7	X	O	X	O	O	O
8	X	X	X	X	O	X
9	X	O	X	X	O	O
10	X	O	X	O	O	X
11	X	O	X	O	O	X
12	X	O	X	O	O	X
13	X	O	X	O	O	X
14	X	O	X	O	O	O
15	X	O	X	O	O	O
16	X	O	X	O	O	O
17	O	O	X	X	O	X
18	X	O	X	X	O	O
19	X	X	X	O	O	O
20	X	O	X	O	O	X
21	X	X	X	O	O	O
22	X	O	O	O	O	O

R. V. ALBATROSS IV

The R. V. Albatross IV arrived in Woods Hole November 28, 1962, on her maiden voyage from the Southern Shipbuilding Corporation at Slidell, Louisiana. From that time, until her first official cruise, several training cruises were made to familiarize the officers, crew, and scientists with the vessel. The "Kort type" nozzle was modified with the addition of fins, and various types of gear were either added or altered to insure a smooth working operation.

On May 9, 1963, the Albatross IV was commissioned at Woods Hole, Massachusetts. Secretary of the Interior Stewart Udall and other distinguished guests were present at the ceremonies.

May 13, 1963, the Albatross IV sailed on her first official cruise to collect quantitative samples of the sea scallop population on Georges Bank.

At the present time the stability, ease of handling all types of gear, and other facilities of the Albatross IV would be hard to exceed by any vessel of similar size.

FURTHER CONSIDERATION OF GROUNDFISH MINIMUM MESH SIZE.

H. W. Graham

Introduction.

In ICNAF there is considerable interest in extending mesh regulation where feasable to all species of groundfish in all Subareas. At the present time there are either regulations or Commission recommendations for regulation for 4-1/2 inch minimum mesh size for all species of groundfish in Subareas 1 and 2; for all species of groundfish in Subarea 3 except for redfish in divisions 3N, 3O, and 3P; for cod, haddock, and flounders in Subarea 4; and for cod and haddock in Subarea 5.

The present report discusses the possible effect of extending mesh regulation to species other than cod and haddock in Subarea 5. The relative importance, in terms of pounds landed, of the various species taken in the Subarea is presented in Table 1. It will be noted that industrial species rank high in this list even though the industrial plants were running at a much lower level in 1960 than in previous years. We have no analysis of the species composition of the industrial landings for that year, but the data for 1958, when the plants were running at greater capacity, will serve to indicate the relative importance of the different species in the New England industrial trawl fishery. These are presented in Table 2.

Sizes of mesh now in use.

The Boston haddock fleet composed of large trawlers regularly uses 4-1/2 inch mesh under the international mesh regulation. Smaller vessels out of Boston and other ports may engage primarily in haddock fishing on some trips and for redfish or whiting or industrial species on other trips. In this case they may register as haddock boats and use 4-1/2 inch mesh for the haddock trips; then cancel their certificates and use smaller mesh nets to engage in other fisheries. In the case of whiting fishing they are likely to catch haddock and cod as well as whiting as these species are frequently found together. Under present regulations a vessel fishing with small mesh may land 5,000 pounds or 10 percent of its trip in cod or haddock or, if it is appropriately registered, land any amount of haddock per trip provided its total landings for the year do not exceed 10 percent haddock and 10 percent cod.

Large mesh is also used on vessels directing their fishing for yellowtail and other flounders, in this case voluntarily. However, here too we have a mixed fish problem. Some vessels engage variously in fishing for yellowtail and for smaller species such as scup, butterfish, and whiting which are used for human food, and for whiting and other smaller species such as red hake which are used for industrial purposes. These vessels usually carry small mesh nets in order to retain these smaller species.

Table 1.--Landings of the more important species of groundfish in United States from Subarea 5 in a typical year (1962).

	000's of pounds (Round, fresh)
Haddock	119,957
Silver Hake	97,448
Yellowtail	56,301
Industrial	53,702
Cod	41,063
Redfish	27,648
Winter Flounder	15,536
Pollock	12,236
Scup	8,659
Red Hake	5,448
White Hake	5,179
American Plaice	4,248
Fluke	3,339
Witch	2,152

Table 2.--Species composition of industrial landings in New England in 1958.

	000's of pounds
Red Hake	62,522
Silver Hake	21,785
Big Skate	8,599
Eel Pout	7,626
Little Skate	7,198
Angler	6,638
Spiny Dogfish	5,813
Long Horn Sculpin	1,838
Sea Robin	1,766
Butter Fish	1,747
Blueback	1,528
Alewife	1,201
Four-Spot Flounder	1,073
Other	7,484
Total	136,819

From Edwards and Lawday, 1960. Special Scientific Report No. 346.

Extend the 4-1/2 inch mesh regulation?

One may say at the start that extending the 4-1/2 inch mesh regulation to all species of groundfish in Subarea 5 cannot be seriously considered. This size is too large to provide maximum sustained yield for such important species as redfish and whiting, and would seriously reduce the catch. Although it would have little effect on vessels fishing specifically for yellowtail flounder, it could not be applied to the yellowtail flounder fishery without causing serious complications with vessels that fish variously for yellowtail and other species, a problem already encountered in the haddock regulation.

Apply a smaller minimum mesh size?

Although extension of the 4-1/2 inch minimum mesh regulation to other species cannot be considered for Subarea 5, it is worthwhile looking into the possible effects of applying some smaller minimum mesh size for the Subarea for species other than cod and haddock. In studying this problem it was found that a minimum mesh size of 3-1/2 inches (double manila) for species other than cod and haddock has considerable merit. It would provide a cleaner catch of all species now taken with smaller meshes, reduce the quantity of undesirably small fish caught but not now landed for the food market, reduce the discard of haddock by the mixed groundfish fishery, and would probably increase the long term yield of whiting.

Silver Hake

This species is marketed for human food, animal food, and for industrial purposes. It is fished with small mesh of different sizes, but mostly below three inches. If we assume present average mesh size to be 2-1/2 inches (double manila); increases to 3, 3-1/2, or 4 inches would have long term benefits after some initial loss. In Table 3 these benefits and losses are tabulated for the total catch of whiting. Since the food fishery is not interested in the smaller sizes of whiting these estimates of initial losses would not apply. They would apply, however, to the industrial fishery. The immediate loss to the landings of silver hake for food would be 8 percent for a 3-1/2 inch (double manila). The long term gains would not be achieved for several years. It would take 8 to 10 years to compensate for the immediate losses.

Figures 1b, 3a, and 3b compare the size compositions of present landings of silver hake with size composition to be expected if a 3-1/2 inch (double manila) net were used.

Table 3.--Effect of increasing mesh size in silver hake nets.

Change in mesh size inches from 2-1/2 to	Percent change in catch	
	Immediate	Long term
3 inches	- 4	+ 4
3-1/2 inches	-22	+13
4 inches	-47	+17

Red Hake.

This species is taken almost entirely for industrial purposes and comprises some 45 percent of the trawl fish industrial catch in New England when this industry is active (Table 2).

Figure 2a. shows the average size frequency of the catch compared with the expected frequency with a 3-1/2 inch mesh. The initial loss would be about 13 percent by weight. Long term benefits are not known.

Redfish.

This fishery currently uses nets with mesh size of about 2-3/4 inches (double manila). Our own studies, and that of ICNAF's Assessment Group have not furnished useable estimates of the effects of increasing mesh size on yields of this species. Figure 1a. presents the length-frequency curve of landings for the present fleet compared with length frequency to be expected under 3-1/2 inch regulation. There is very little discarding and the 3-1/2 inch double manila would apparently decrease the immediate landings by about 7 percent by weight. Note that the losses would be in the sizes considered undesirable by the food market. There is some evidence that the large commercial sized catches would reduce considerably the calculated escape rate in which case the initial losses would be less than 7 percent. Long term benefits cannot be estimated at the present time.

Flounders.

Figure 4 presents length frequencies of the landings for the four larger species of flounder taken in Subarea 5. The 50% selection point of the 3-1/2 inch mesh for these species is considerably below the smallest sizes landed in 1957-59. The inclusion of these species under a 3-1/2 minimum mesh regulation would have little immediate effect on landings. In some years when flounders are unusually abundant and there is a glut on the market, large quantities of small fish are said to be caught and discarded at sea even by vessels using large mesh nets (4-1/2 to 5 inches). The extent of this discard and the viability of flounder under these conditions are unknown. In any case the institution of a 3-1/2 inch mesh regulation is not likely to change either the immediate or long term yield for these four species.

The situation is different as regards one of the smaller species of flounder, the dab. Figure 2b. compares the size distribution of dab caught in 1956-59 with that to be expected if 3-1/2 inch (double manila) mesh were sued. In the case of this species the catch would suffer a 21 percent immediate loss. The 3-1/2 inch mesh would, however, retain all fish of a size desirable for food. Whether any long term benefits would accrue is not known. Dab is, of course, one of the minor species in the total New England landings. About 1.8 million pounds were landed in 1960.

Haddock.

As mentioned above there is some quantity of haddock taken by vessels using small mesh nets. Some of these vessels are seeking haddock while others are catching them incidentally to the catch of other species such as whiting. In any case, they land under some exemption to the haddock regulation. The disposition of these haddock catches depends upon whether or not the industrial plants are operating and accepting trawl fish. The haddock catch is culled on board. The larger sizes are sold to the food market and the smaller ones are either sold as trash or, if the trash plants are not operating, discarded at sea. Discarded haddock are not viable and are lost to the fishery.

The magnitude of the catch of undersized haddock (i.e., haddock below the sizes taken by the regulation 4-1/2 inch mesh) is difficult to determine as obtaining data on this involves sampling the discard of the small mesh fleet which is composed of smaller vessels and sampling the industrial landings. During the period 1957-59 when the industrial fishery was operating actively in New England, the average landings of haddock for industrial purpose was 3 million pounds per year. These were all undersized fish as defined above, the food market size having been culled out.

Although the industrial fishery is not now operating fully, there is heavy fishing in areas where small haddock abound. In 1962 about 25 percent of the haddock landed in the U.S. (representing about 26 million pounds) was landed under some exemption and, therefore, was presumably caught with small mesh (Table 3). The vessels concerned were in general the same fleets that participated in the industrial fisheries in 1957-59, and generally fish the same grounds. Thus, it is only reasonable to suppose that they are taking undersized haddock as well as larger sizes. Since the food market does not normally accept haddock under 38 cm., the 50 percent selection size of the 4-1/2 inch mesh, the undersized haddock apparently are now being discarded at sea.

No mesh size under 4-1/2 inches will completely eliminate this discard, but a 3-1/2 inch mesh would materially reduce it (Table 4). General use of a 3-1/2 inch mesh by these vessels would reduce the catch of undersized haddock by 80 percent. This would serve to increase the sustained yield of haddock from Subarea 5.

Table 4.--Analysis of haddock landings by type of certificate for Subarea 5 and for all Subareas, 1962. 1/

	Subarea 5		All Subareas	
	Haddock Landed 000's pounds (gutted weight)	% Haddock	Haddock Landed 000's pounds (gutted weight)	% Haddock
Registered Cod and Haddock Vessels	78,740	75.0	88,019	74.9
Non-Registered Vessels	26,261	25.0	29,440	25.1
Totals	105,001	100	117,459	100
Non-Registered Vessels Breakdown				
10% Annual Exempted	3,834	3.7	4,088	3.5
Trip Exempted	19,724	18.7	22,649	19.3
Other gear	2,703	2.6	2,703	2.3
Totals	26,261	25.0	29,440	25.1

1/--On a trip basis.

Table 5. Sizes of haddock landed by Gloucester industrial fishery, 1957-59[1/]

Length (cm.)	Ipswich Bay number	Stellwagen Bay number	Nausets number	Total Number	Total Percent
>9			4	4	-
9			9	9	1
12	1	5	9	15	1
15	4	30	5	39	3
18	16	29	23	68	5
21	35	28	85	148	12
24	33	41	117	191	15
27	35	84	141	260	21
30	19	142	103	264	21
B					B
33	27	78	65	170	14
36	17	12	27	56	4
A					A
39	10	3	7	20	2
42	3	1	--	4	-
45		1	--	1	-
48			1	1	-
51			1	1	-
Total				1,251	100

1/ From Edwards and Skerry, 1961.

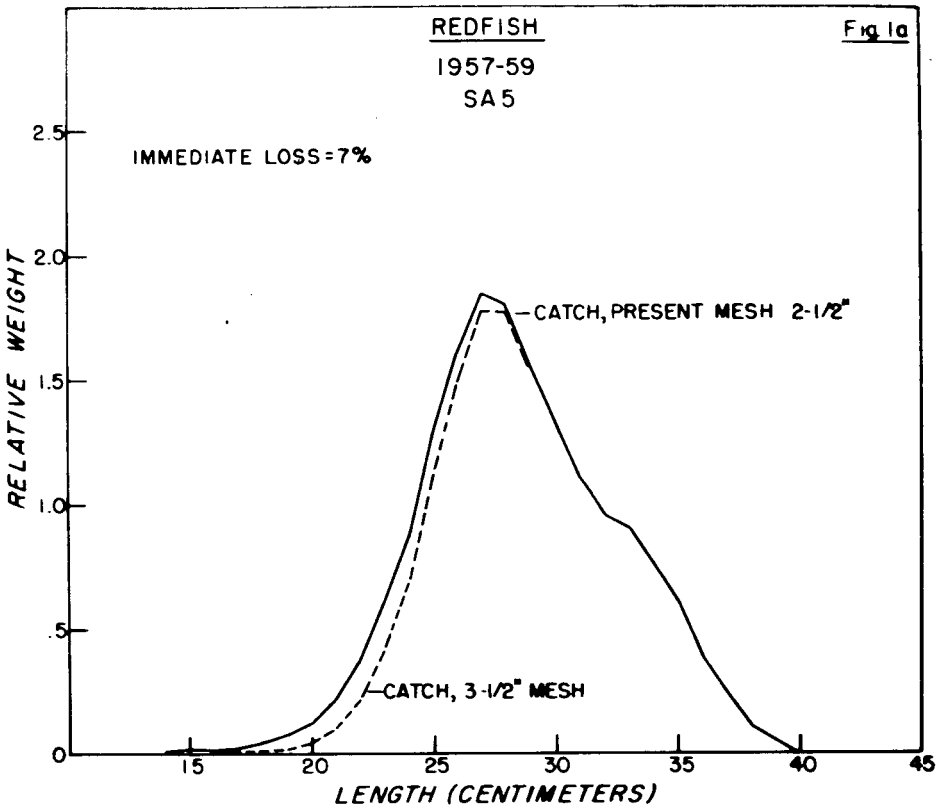
A-A = 50% selection point of 4-1/2 inch mesh.

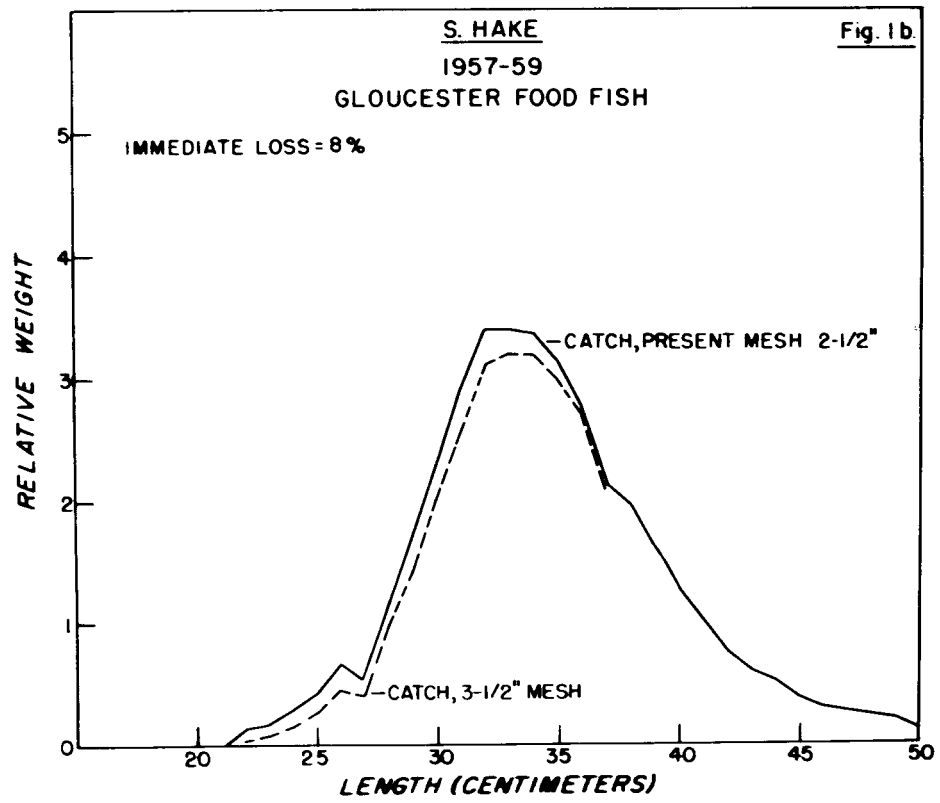
B-B = 50% selection point of 3-1/2 inch mesh.

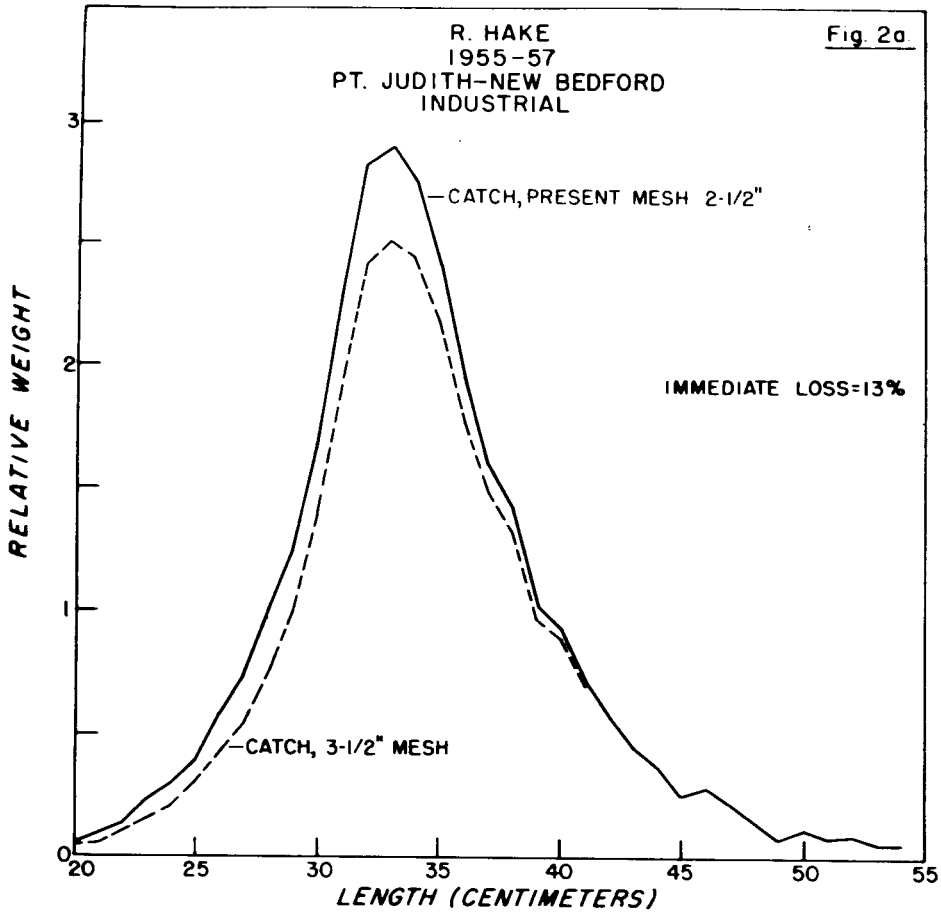
Conclusions.

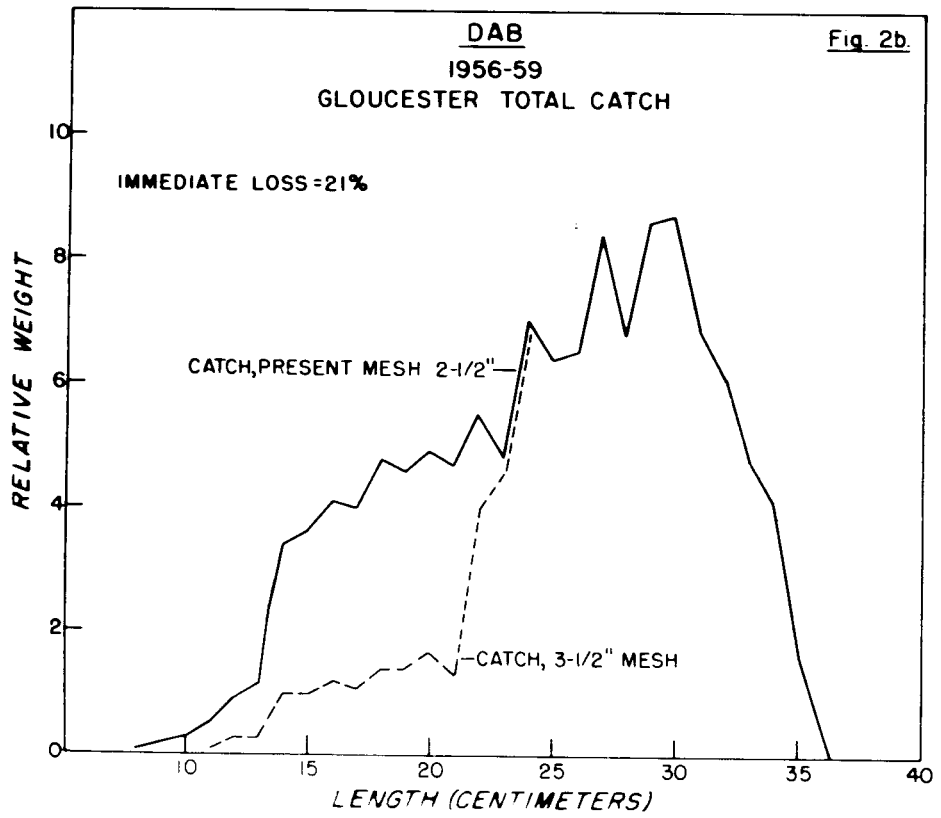
1. Extension of the 4-1/2 inch minimum mesh size regulation in Subarea 5 to all species other than cod and haddock is not desirable as it cannot be shown to be beneficial from a conservation standpoint and would be injurious to a number of fisheries.

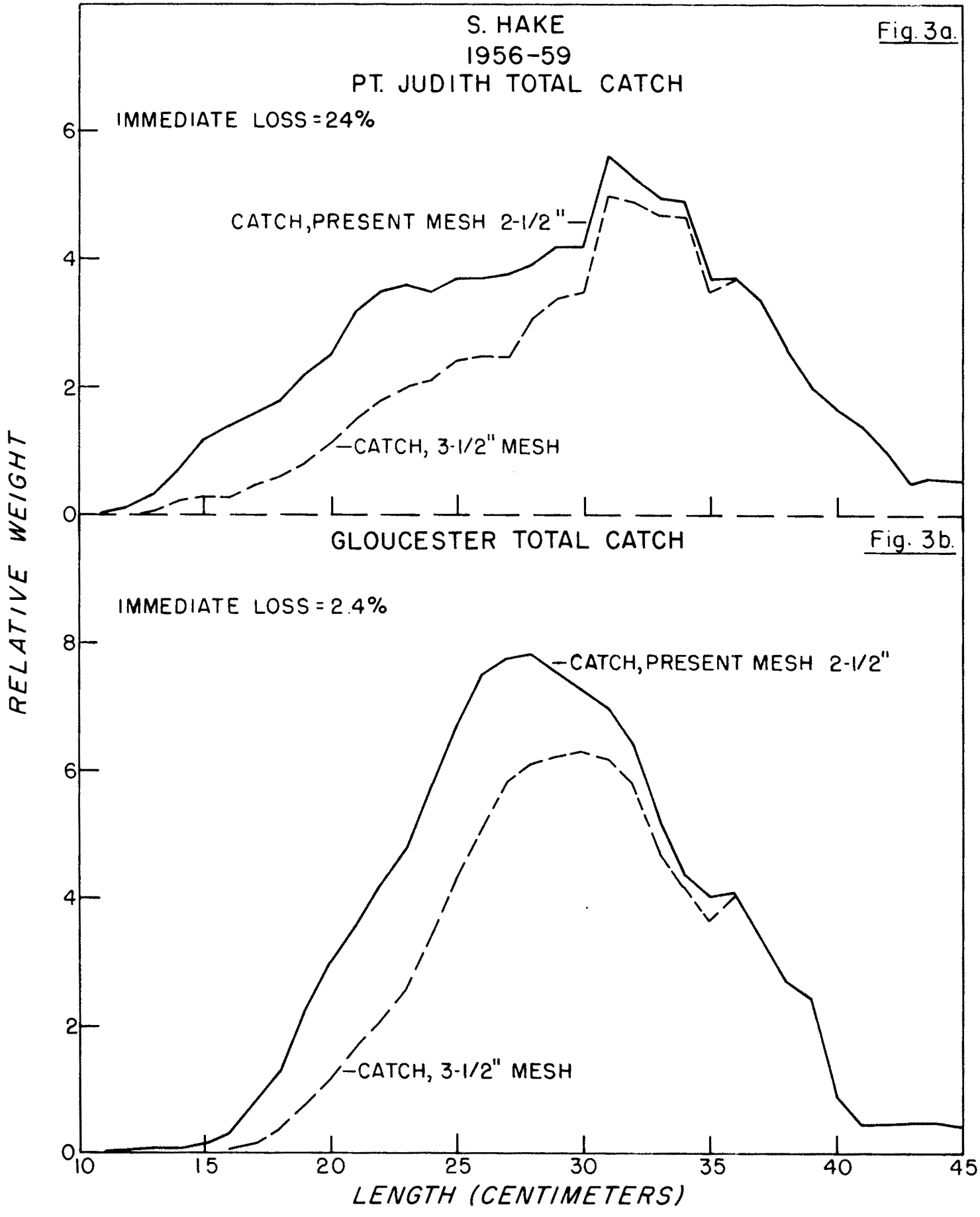
2. Adoption of a minimum mesh size of 3-1/2 inches (double manila) for species other than cod and haddock is of some merit and is worth considering. It would materially reduce the destruction of undersized haddock; produce cleaner catches of all species by reducing the debris in the net; reduce the quantity of undesirable sizes of many species; and increase the long term yield of whiting. On the negative side it would immediately reduce the amounts landed of red hake (8 percent)and silver hake (21 percent) and possibly some other industrial species unless some exemptions were worked out for these.

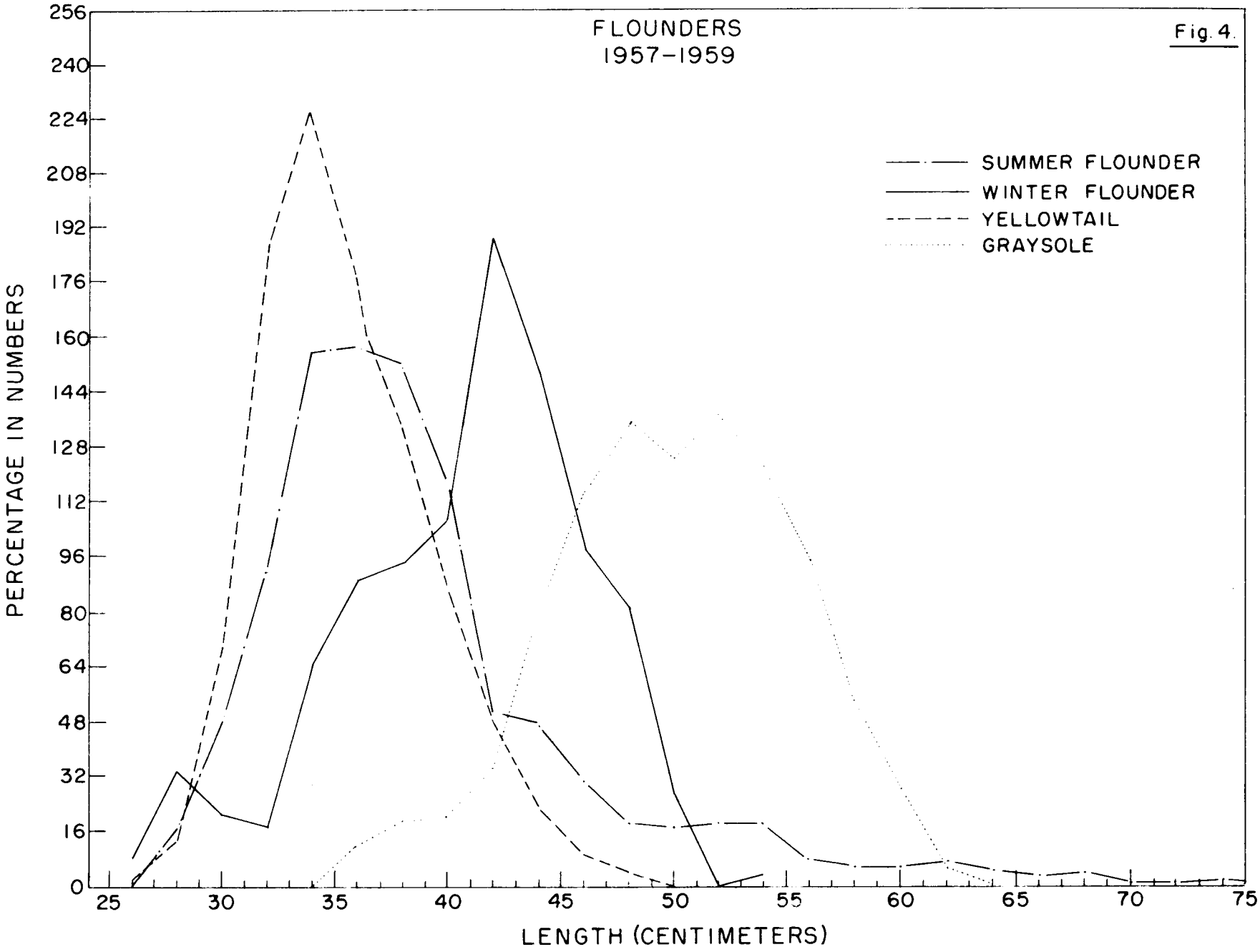

REDFISH
1957-59
SA 5
Fig. 1a
IMMEDIATE LOSS=7%
RELATIVE WEIGHT
2.5
2.0
1.5
1.0
.5
0
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
15
20
25
30
35
40
45
LENGTH (CENTIMETERS)


S. HAKE
1957-59
GLOUCESTER FOOD FISH
Fig. 1b.
IMMEDIATE LOSS=8%
RELATIVE WEIGHT
5
4
3
2
1
0
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
20
25
30
35
40
45
50
LENGTH (CENTIMETERS)


R. HAKE
1955-57
PT. JUDITH-NEW BEDFORD
INDUSTRIAL
Fig. 2a
RELATIVE WEIGHT
CATCH, PRESENT MESH 2-1/2"
IMMEDIATE LOSS=13%
CATCH, 3-1/2" MESH
LENGTH (CENTIMETERS)


DAB
1956-59
GLOUCESTER TOTAL CATCH
Fig. 2b
IMMEDIATE LOSS=21%
RELATIVE WEIGHT
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
LENGTH (CENTIMETERS)


S. HAKE
1956-59
PT. JUDITH TOTAL CATCH
Fig. 3a.
IMMEDIATE LOSS = 24%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
GLOUCESTER TOTAL CATCH
Fig. 3b.
IMMEDIATE LOSS = 2.4%
CATCH, PRESENT MESH 2-1/2"
CATCH, 3-1/2" MESH
RELATIVE WEIGHT
LENGTH (CENTIMETERS)
0
2
4
6
8
10
15
20
25
30
35
40
45


FLOUNDERS
1957–1959
Fig. 4.
SUMMER FLOUNDER
WINTER FLOUNDER
YELLOWTAIL
GRAYSOLE
PERCENTAGE IN NUMBERS
256
240
224
208
192
176
160
144
128
112
96
80
64
48
32
16
0
25
30
35
40
45
50
55
60
65
70
75
LENGTH (CENTIMETERS)